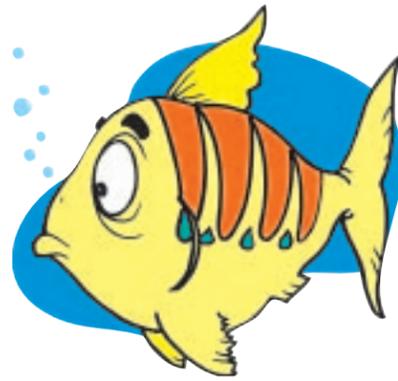
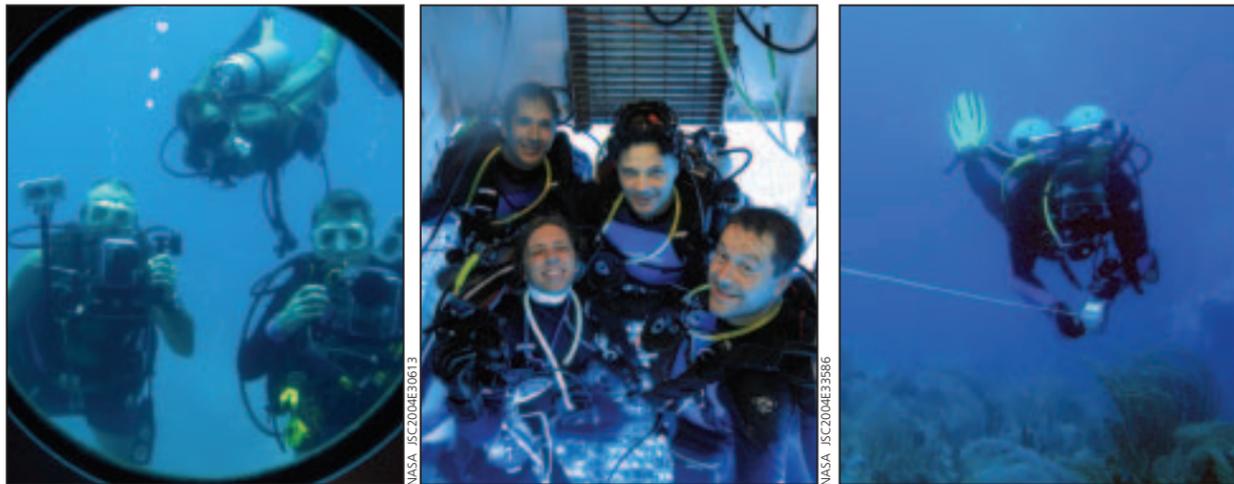


# FINDINGS from NEEMO



by Kendra Phipps



This time, NEEMO was the one doing the “finding” – to be specific, the crewmembers of the sixth expedition of the NASA Extreme Environment Mission Operations (NEEMO) project found some valuable insights into spaceflight when they lived below the Florida Keys in July.

“Nick (Patrick) once asked me toward the end of the mission if I could sum up my thoughts about our experience with NEEMO in one word, and I replied ‘Learning,’” Tara Ruttley, biomedical engineer and NEEMO 6 crewmember, said. Astronaut Patrick was one of her fellow aquanauts, along with Astronauts John Herrington and Doug Wheelock.

“This NEEMO mission has given me the most unique perspective of how flight hardware should be handled in a way that no other engineering training, academic course work or flight hardware laboratory could provide,” Ruttley said.

NEEMO allows a crew of “aquanauts” to live and work in the Aquarius Underwater Laboratory off the coast of Key Largo, Fla. for several days to gain insight into life in space. The extreme environment of Aquarius – a 45-foot long, 13-foot diameter complex about 62 feet beneath the surface – makes it a well-suited analog for another extreme environment: the International Space Station.

NEEMO 6 was dedicated to biomedical engineering research that will benefit future spaceflights. Some of the mission’s scientific experiments included:

- evaluation of the Constant Force Resistive Exercise Unit, a novel resistive exercise machine
- determining the efficacy of silver ion technology as an antimicrobial countermeasure in an enclosed environment
- evaluation of a wireless medical monitoring device as well as wireless tracking hardware
- assessment of the Portable Bone Quality Assessment Device, a handheld noninvasive device designed to evaluate bone quality

Crewmembers also exited the Aquarius on diving excursions simulating spacewalks and built underwater structures – an activity analogous to Space Station assembly activities.

Another highlight of the mission was the chance to speak directly with Expedition 9 Space Station Science Officer Mike Fincke. The “ship-to-ship” downlink took place on July 15.

“NEEMO really is an excellent test bed for Station,” Fincke said. He was an aquanaut himself on the NEEMO 2 mission.

“Working as a team is the way to solve all the problems of exploration no matter what the venue – underwater, in space, communicating with Mission Control,” Fincke said. “It’s a pleasure and it’s also the only way to get things done. People need to realize that things never work out right the first time – well, maybe in ‘Star Trek’ – so we need to do what human beings do best, and that’s problem solving.”

To listen to the downlink, go to <http://spaceflight.nasa.gov/gallery/audio/station/crew-9/ndxpage1.html>

Below are some excerpts from the NEEMO 6 crewmembers’ journals. For the full entries, visit <http://spaceflight.nasa.gov/shuttle/support/training/neemo/journals/neemo6/>.

### John Herrington

One of the things that my parents like to do at their home in Spicewood, Texas is to sit on the front porch and watch the sun go down. All sorts of animals make their way across the stage of Texas hill country. ... Where my parents would expect the occasional animal to make its presence known, I faced a multitude of sea life, swimming in the light and shadows. Fish in all shapes and sizes, casting flashes of light like a mirrored ball on a dance floor. And it was a dance! Fish were darting about in an endless cascade of movement. It was as pleasing as any moment I have spent on my parent’s porch. Just a view from a different world, but one where life is just as full and remarkable as the one above. ...

I leave this experience with a much deeper appreciation for the life that exists in the sea. It is a wondrous environment full of beauty, brimming with life, from the smallest plankton to the magnificently agile manta rays. I also leave with a profound and abiding respect for the men and women that live and work under the surface of the sea. Their work is just as dangerous as flying in space and they relish the challenge just like those of us in the astronaut corp.

### Tara Ruttley

I will never look at (flight hardware) systems the same way again. Words on JSC Engineering documents, minutes at meetings, crew debriefs, hardware part numbers, schematics, drawings and procedures will now have a different meaning to me.

Even the hardware that performed so beautifully in the lab had its own personality in the Aquarius habitat: some due to the unique environment (humidity, pressure, etc.), some due to computer hiccups, and some due to random other things that we could have never even anticipated. It’s the beauty of using this environment and this particular mix of crew to adequately evaluate such hardware in its early prototype stages as a

potential for spaceflight. It’s the closest end-to-end testing you’ll ever get before spaceflight development.

### Doug Wheelock

Our days were full of science and engineering tasks each day, both outside and inside the habitat.

We have very clear objectives each day, yet the sea meets us each morning with surprises that remind us that we are just visitors here.

It was great to be on the operational end of a real mission and to understand the importance of good, clear communication before, during and after tasks both inside and outside Aquarius. ...

Early in the mission, as John Herrington and I were working on the pinnacle excursion line to the south of the habitat, we saw the most incredible sight, and my mind keeps replaying the spectacle. I suppose it is one of those things that I will remember for life. We saw two huge Manta Rays swimming loops next to each other on a feeding run. Boy, talk about feeling like a visitor! I’ll never be the same after seeing that.

*The days of doctors making house calls may seem like ancient history for most North American patients, but in October, three astronauts and a Canadian doctor will test the latest concepts in long-distance house calls during NEEMO 7.*



Above: The NEEMO topside core team takes a break between NEEMO 6 dives. From left: Monika Schultz, Astronaut Office Representative; Bill Todd, NEEMO Project Lead; Marc Reagan, NEEMO 6 Mission Director; Michelle Lucas, NEEMO Operations Planner.

Facing page, from left to right: NASA and National Undersea Research Center staff greet the crew through Aquarius’ Main Lock V-Port.

The NEEMO 6 crew is pictured in the Aquarius ‘wet porch’ before an extravehicular activity. From left: Astronaut John Herrington, Biomedical Engineer Tara Ruttley, Astronaut Doug Wheelock, Astronaut Nick Patrick.

Aquanaut John Herrington deploys an excursion line for a coral science task.

J S C W E L C O M E S

# new explorers

by Julie Burt

**THE FIRST ASTRONAUT CANDIDATES** selected since President George W. Bush called for America to go out “into the cosmos” are ready to step into their roles as ambassadors of the space program and to help implement the Vision for Space Exploration.

“I think it’s what we’re really called to do as humans,” said James P. Dutton, Jr., Major, U.S. Air Force, and Pilot candidate. “We’ve always been meant to be explorers and to push the boundaries of what we know and understand.” Dutton said he is excited to contribute to the development of the new vehicles that will take humans out of low Earth orbit.

The candidates reported to Johnson Space Center this summer. After they were issued their flight suits, the nine Mission Specialist candidates, including three JAXA astronauts and three Educator Mission Specialist candidates headed to Naval Air Station Pensacola to start training.

In Florida, the candidates were given an introduction to aviation systems and aviation physiology. They also spent time learning emergency exit equipment and procedures, as well as survival training.

Educator Mission Specialist candidate Dottie Metcalf-Lindenberger, who is a science teacher and a marathon runner, said she knows what it is like to train. She said she knows what pain is and how to suffer through it.

“But I also know what the goal is,” she said. “And the big thing in training and endurance is to just keep going ... So, I think that will be the same in (astronaut candidate) training. I’ll work really, really hard and then one day it’ll all pay off.”

While the Space Shuttle is grounded and the Crew Exploration Vehicle is being developed, the new candidates are ready to learn all they can in preparation for their upcoming assignments. Upon arrival at JSC Aug. 9, the astronaut candidates will start an approximately 18-month training period.



Former astronaut and U.S. Senator John H. Glenn Jr. is surrounded by NASA’s newest astronaut class, backdropped by the Space Shuttle Enterprise at the National Air and Space Museum. From the left are Joe Acaba, Jose Hernandez, Jim Dutton Jr., Bobby Satcher Jr., Tom Marshburn, Dottie Metcalf-Lindenberger, Ricky Arnold II, Shane Kimbrough, Chris Cassidy and Shannon Walker. Not pictured is Randy Bresnik, the eleventh member of the 2004 astronaut class.

First, there will be an overview of JSC functions and facilities. Land survival training is next, followed by flight training. Along with learning about the T-38 trainer aircraft, the candidates will have a familiarization flight on the KC-135. The pilots will then have time in the Shuttle Training Aircraft.

From there they will train frequently in T-38s. Mission Specialist and Educator Mission Specialist candidates will spend 12 hours per quarter in T-38s, while Pilot candidates will spend 15 hours per month training in T-38s.

For the next few months, the candidates will be taken back and forth to NASA Headquarters and to each NASA Center. During these visits, they will have historical and anecdotal sessions with former astronauts, managers and subject matter experts. These visits are important in understanding what each

Center does, since the astronaut candidates are now ambassadors for the space program.

Shuttle Systems and International Space Station Systems training will take up a good portion of their time for the next year or so. The candidates will also have a 32-hour Russian language introduction. Finally, geophysical field training, exploration field training, SCUBA certification and the National Outdoor Leadership School will all be completed by Spring 2006.

